ANOMALOUS COGNITION TECHNICAL TRIALS: INSPIRATION FOR THE TARGET ENTROPY CONCEPT

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ABSTRACT

Two anomalous cognition trials are presented in which the targets were high-technology directed energy systems. The protocols, fuzzy-set analyses, and results are presented in the context of exploration and hypothesis formulation rather than hypothesis testing. The qualitative success of these trials, considered alongside similar successes throughout the years of the SRI International and Science Applications International Corporation, US-Government-sponsored programmes, inspired the design of the Shannon entropy experiments that were conducted in the Cognitive Sciences Laboratory in 1993 and beyond. Potential target confounds are also discussed in the context of these trials.

INTRODUCTION

Hypothesis formulation and testing are the cornerstones of modern research. We have become focused on the former and have become quite proficient with these tests. Because of resource limitations and journal and/or grant-proposal restrictions, exploratory or hypothesis-formulation oriented experiments rarely appear in the literature. Discussions of hypotheses are usually restricted to theoretical papers or pilot studies. But the attitude of 'Let's try something and see what happens' is a necessary part of a balanced approach to good research and should be more widely spread.

Background

Extrasensory perception (ESP) has very probably been with us since the dawn of history. It is beyond the scope of this paper to provide a detailed history of ESP (perhaps under different names) and the interested reader is referred to such reviews as are easily available on the net.[1] These include reports of prophecies of various kinds such as those induced by drugs, dreams, and meditation, and special insights provided by shamans and other spiritual masters. Honorton (1975a) provides a well-referenced history into the research literature on ESP. In addition, we provide a sample (by no means complete) of some of the papers or books on a form of ESP called remote viewing (Jahn, 1982; Schwartz, 2007; Targ & Targ, 1986; Targ, 1975, 1994a, 1994b, 1996; Targ, Katra, Brown & Weigand, 1995; Targ, Targ & Harary, 1984).

In 1972 Puthoff and Targ started the US-Government-sponsored ESP programme now known by its latest nickname 'Star Gate'. Their seminal publication (Puthoff & Targ, 1976)[2] provides details of how experiments are conducted in what they called remote viewing. One of the primary differences between remote viewing and other free-response protocols such as the ganzfeld

[1] *Wikipedia* provides a starting point at http://en.wikipedia.org/wiki/Extrasensory_perception.

[2] The PDF version (10.3 MB) may be viewed and downloaded from http://www.lfr.org/LFR/csl/library/IEEE1976.pdf.

is that beyond the basic ideas of blindness and random selection of targets there is no specific protocol. For example there are a wide array of different methods to direct an experiment participant toward an intended target. These include asking a participant to describe the physical surroundings of a distant experimenter; directing a participant to a spot on the earth via geographical coordinates or their encrypted versions; asking a participant to describe his or her first impressions after hearing a meaningless stimulus word such as 'target'; or having the participant describe the target that they will see in a short while—precognitive targeting.

A trial in an ESP experiment that uses an experimenter as the targeting method requires a 'psychic' participant, a 'monitor', who remains with the participant throughout the trial, a second experimenter to serve as the 'beacon' and an analyst. Once the monitor and participant have been sequestered in a laboratory, the second experimenter (E2) randomly chooses one physical location from a predefined set called a target pool. At this moment the monitor and the participant are blind to this target choice. E2 then travels to that location and remains there for about 15 minutes during which time he or she attempts to experience the site as much as possible. Meanwhile back in the laboratory, the monitor is free to ask the participant non-leading questions in order to elicit as much information as possible about the site where E2 is currently located. The participant is encouraged to write and draw his or her impressions. When the session is over, these data are copied and the original is secured. Then the monitor and the participant travel to the selected site so as to gain feedback about the accuracy of their impressions—naturally this does not imply or constitute a formal analysis.

There are many ways in which to analyze the output from such trials. The most common technique in use in remote viewing studies is the rank-order method, in which an analyst who is blind to the target choice is presented with the original response and a set of targets which include the intended target for the trial.[3] The analyst's task is to select which of the targets best matches the response, then select the second best match, third best, and so on. After a number of such trials, the null hypothesis of no ESP can be tested using simple statistical methods.

Background for Technical Targets

One of our US-Government sponsors was interested in determining the degree to which elements of high-technology targets could be sensed by anomalous cognition (AC).[4] It is in the context of hypothesis formulation that two trials (conducted a year apart) were carried out with complex high-technology systems as targets.

During the Cognitive Science Program at SRI International, we were often

[3] In traditional ganzfeld studies, the judging packet contains four targets; in the later remote viewing studies the pack contained five targets; in Puthoff & Targ's original remote viewing studies there was a variation on the rank-order method that often contained nine targets in the pack.

[4] We have adopted the term 'anomalous cognition' instead of the more familiar terms such as 'psi', 'ESP', 'remote viewing', and 'ganzfeld' because we feel that this term is mechanism-neutral and closer to the actual observable: we become aware (i.e. have a cognition) of something in ways we currently do not understand (i.e. anomalous).

asked to explore the efficacy of AC in a variety of situations. Contractual agreements rarely allowed for an opportunity to make these or similar widely separated trials into any semblance of a formal experiment. Yet, these trials were not wasted in that they provided insight into data-collection protocols, potential mechanisms, and analysis techniques that have led to formal and publishable experiments (e.g. May, Spottiswoode & Faith, 2000; May, Spottiswoode & James, 1994).

Two such trials have been selected from our collection to illustrate specific points about the AC process and to present some of the data that inspired the hypothesis that changes of entropy may be related to target visibility in experiments (May et al., 1994; May et al., 2000). The analyses were all done *post hoc* and no statistical calculations were performed. The success or failure of the approach can only be assessed by the outcomes of carefully executed experiments that test the concepts that were inspired by the trials shown in this paper. These examples nonetheless are worthy of public discussion because the qualitative correspondences of the responses to their intended targets may inspire others to explore different directions, and there may be value in understanding the circumstances that produced the entropy experiments.

In these trials, a single participant was targeted on a designated individual and asked to describe that person's surroundings — not unlike the remote viewing experiments of Puthoff and Targ (1976). The difference was that these targets were complex, high-technology, directed energy systems and definitely not randomly selected. For each trial, the sponsor received a lengthy final report describing the protocols, analysis, conclusions, and all the raw data.

In this paper, we summarize the information from these reports, show the qualitative and quantitative agreement with the targets and demonstrate an application of fuzzy-set analysis (May et al., 1990) to technical targets. We review briefly some basic ideas of sets.

A traditional set (called a 'crisp set') is simply a collection of items that share a common property; for example, the set of cities that possess 1,000,000 people or more would include New York, New Delhi, London and Hong Kong. However a city that has a population of 999,999 (i.e. one person short of a million) would by definition not be a member of this set. Zadeh (1965) realized that this kind of reasoning is not the way people actually think about problems. In this example there is no real difference between a city of one million people and one that is one person short of that number. Zadeh invented fuzzy sets. Like crisp sets, they are simply a collection of items that generally share a common property, but using fuzzy sets, it is possible to construct a set of 'reasonably large cities' in which cities that differ by an insignificant number of people would still be members of the set. In other words, fuzzy sets allow quantification of the ambiguous — what better mathematics to apply to ESP research?

Brief Tutorial on Entropy

The concept of entropy arises from classical thermodynamics in physics. Although the mathematics of various theories rapidly becomes difficult, the conceptual framework is rather straightforward. One approach is to think of entropy as a measure of chaos or to the related idea of uncertainty. Ice, for

example, has much lower entropy than water. Why? Because the molecules of water in liquid form are bouncing around in a chaotic fashion, whereas in ice these same molecules are all lined in an ordered array we call a crystal. Also in liquid water the position of a given molecule is very uncertain, whereas in ice the position of a molecule is far more certain since it is trapped in a crystal and is not going anywhere.

A related concept comes to us as the Second Law of Thermodynamics, which states that for isolated systems, entropy cannot decrease. Suppose you knock a glass (ordered system) to the floor and it shatters (i.e. a transition from low to higher entropy). Now imagine picking up the pieces, placing them on the table, and then knocking them to the floor again as a bunch. What happens? The Second Law tells us that the entropy can never decrease, which is what must happen if the shattered pieces are to assemble themselves into a glass when they hit the floor.

With regard to this paper, consider an underground nuclear blast. Before the explosion, the nuclear material is in a low entropic state; that is, the atoms of uranium exist in a sold form inside the bomb. Microseconds after the bomb is detonated, nearly all the uranium is vaporized; the surrounding earth (low entropy) is violently scattered (high entropy). In short, such a blast represents a huge increase of entropy in a very short time.

This paper shows that these types of targets were apparently very easy to detect using anomalous cognition and they served as the basis for developing the testable hypothesis that anomalous cognition will positively correlate with the change of entropy of the target systems. Between 1987 and 1990, we conducted only three trials in which the target systems were pulsed, high-energy systems. The first two trials were analyzed by a fuzzy-set technique; however, the third and final trial in the series was never analyzed because the contract expired and we could not obtain the necessary target material to complete the analysis.

First Trial, May 1987

It is important to specify who knew what and when in this trial. One of us (May), as project director, was completely informed about the details of the trial, the identity of the sponsor, and the target system. The participant, an anomalous cognition-monitor (Lantz), and the remainder of the SRI staff were blind to all these details. They knew, however, that significant attention was focused on the trial and that the target system was in the San Francisco Bay Area. It was reasonable for the participant to assume that the target might be of a technical nature, given all the attention for the trial. The San Francisco Bay Area, however, is rich with technical target possibilities. For example, there are many aerospace companies, semiconductor manufacturing facilities, particle accelerators, radar installations, military air fields, and naval bases. Thus, we felt that the trial was not significantly compromised.

Protocol

On 6 May 1987, the participant travelled to Menlo Park in preparation for a 24-hour trial that was to begin at 0800 hours the next day. He and Lantz were told that an individual from the sponsoring organization, who was described by

name and Social Security number and who was not known to any of the SRI International staff, would be at the target site area during the AC sessions. In addition, they were told that, as part of the trial, two members of the SRI Cognitive Sciences Laboratory staff who were known to them would serve as 'beacons' and would be at the specific target of interest between 2200 hours on 7 May and 0800 hours on 8 May.

Four sessions were conducted to provide information at approximately 8-hour intervals. The time and circumstances were as follows. The participant was asked to describe the surroundings with respect to the sponsor's on-site representative-beacon:–

1. 08:00 Hours. The geographical and the gestalt of the area of interest as defined by the presence of the beacon. He was also asked to provide as much detail as possible in real-time, that is, at 08:00 that day.

2. 10:10 Hours. The details and activity at the site as of 00:00 hours on 7 May (i.e. the previous night when the beacon was present). This is an example of anomalous cognition of a past event, namely to describe features of the beacon person's location as it had been 10 hours and 10 minutes earlier.

3. 16:00 Hours. The details and activity (in real-time) at the site where the beacon was at this time.

4. 24:00 Hours. The details and activity (in real-time) at the site also designated by the two SRI personnel.

During each session, the participant's responses were tape-recorded, and he was encouraged to draw details whenever possible. Because of the appropriate blinding condition, the monitor (Lantz) was free to seek clarification of specific points throughout the sessions. This participant provided responses mostly of labelled drawings; however, others' responses are mostly written in terms of phrases with few drawings.

Analysis Technique

The data were analyzed by a variant of the fuzzy-set technique as described above and by May et al. (1990). In this section we provide a review of that procedure and outline the specific application for this trial.

Descriptor lists, which have been used in AC analyses (Honorton, 1975b; Jahn, Dunne & Jahn, 1980) are examples of crisp sets. That is, for example, the answer to the question, "Is the target primarily indoors?" must be either yes or no. Fuzzy sets, as we indicated above, are not as restrictive; they were invented to address subjective concepts quantitatively (Zadeh, 1965). In another example, an important feature of a target might be 'shady'. A fuzzy-set question for this feature might be, "Rate on a scale between zero and one, the degree to which you feel that the concept 'shady' characterizes the target". A target encoder could answer '0' for a Sahara desert target or '1' for a rainforest, or more probably something in between, such as '0.6' for a city park on a sunny day. In other words, fuzzy sets allow the capture of ambiguous concepts in quantitative terms. Thus, a given item does not have to be in or out of a set as in a crisp set, but can be partially in the set as the last example indicates.

May et al. (1990) emphasize that the analysis of AC data with fuzzy sets is quite general. An experimenter is free to choose the type of elements he or she

wishes to examine in the target. In their application, they used visual relevance to the overall target as their metric. In the examples shown in this paper, importance to the overall technical target of any kind was used instead. The formal definition of a target fuzzy set and a response fuzzy set follows below, regardless of the meaning of the specific elements. Both sets are drawn from a specific collection of such items called the 'Universal Set of Elements' (USE).

Universal Set of Elements

In general, a USE for anomalous cognition is a list of items that may be in a given target or response. These elements are completely general and could be a list of objects, how certain things are related to each other, actions, or functions (i.e. what the site was designed for) or anything at all under consideration for the trial.

A given USE is totally dependent upon the experiment goal and to some extent the AC skill level of the participants, as it should incorporate what is known to be possible to capture via anomalous cognition. For example, it is generally known that free-response participants can more easily identify gestalts of the target such as rivers or cities as opposed to technical details such as a 10-digit combination of a padlock. A properly designed USE should take this into account, as well as other idiosyncrasies related either to the participants or the task at hand.

For this trial and the one following, the USE elements and their weights were determined *post hoc* by the sponsor and one of us (May) while we remained blind to the response. The USE was later extended by the response elements that were not present in the target but were present in the response. The USEs were unique to each target, and the participant was kept blind to the elements to avoid guessing about the targets.

Formal Target Definition

The target is a fuzzy set, T, derived from the universal set of elements, where the *k*th element is characterized by a membership value, T_k, and an associated weighting factor, w_k. The fuzzy-set membership values represent the degree to which a specific element is considered part of the fuzzy set for a given target, and range between zero and one, inclusively. For example, suppose that the element 'testing shielding effectiveness' is only apropos to 20% of the total target system. Then the membership value for this element would be 0.2 (these membership values were arbitrarily constrained to be in steps of 0.1).

The weighting factors, w_k, allow for adjusting the elements of the target fuzzy set towards trial relevance. For example, suppose that the sponsor was primarily interested in determining the degree to which AC can be used to sense 'testing shielding effectiveness', regardless of its membership value; this weighting factor could be set five times larger than any other weighting factor in T to emphasize this specific element. In the session described below, if the participant mentioned items that were not present in the original target fuzzy set, then these elements were later added to the USE and assigned a membership value of 0.0 in the target fuzzy set.

Formal Response Definition

The AC response is a fuzzy set, R, that is also derived from the universal set of elements, where the kth element is characterized by a membership value which also ranges between zero and one, and—differing from their definitions for the target — represent the degree to which an analyst is subjectively convinced that the kth element is a member of R. For example, consider a USE element of shielding, then declarative statements such as "there is shielding at the target" would receive a membership value of 1.0 because it is clear, by definition, that there is no ambiguity about the shielding element being present in the response. However, "something massive at the site" might only be assigned a membership value 0.40, to capture the ambiguous nature of that response element, because there may be many things that are massive but not at all related to shielding. As with the targets, the membership values were arbitrarily constrained to be in steps of 0.1.

Accuracy, Reliability and Figure of Merit

For a given trial, there exists a fuzzy-set representation of the target, T, and the anomalous cognition response, R, to that target. The accuracy is defined as the percentage of the target material that was described correctly and is given by:–

$$accuracy = \frac{\sum_{k=1}^{n} w_k \times \min(T_k, R_k)}{\sum_{k=1}^{n} w_k T_k},$$

where n is the number of elements in the USE. The accuracy ranges between zero and one, inclusively, and is constrained to be in steps of 0.1.

The accuracy is not a good measure of anomalous cognition by itself because if a response were long enough (e.g. using the *Encyclopaedia Britannica* as a response) then the accuracy is always high and could easily approach one (its maximum) by chance alone. To guard against this artifact, we define reliability as the percentage of the response that is correct and it is given by:–

$$reliability = \frac{\sum_{k=1}^{n} w_k \times \min(T_k, R_k)}{\sum_{k=1}^{n} w_k R_k}.$$

The reliability ranges between zero and one, inclusively and is constrained to be in steps of 0.1. Reliability is also not a good measure of AC by itself. Suppose a response consists of the single element "outside", then for many targets this response could have a reliability of one (its maximum) by chance alone.

The figure of merit, which is defined by accuracy × reliability, turns out to be a rather sensitive measure of anomalous cognition. Since both accuracy and reliability range between zero and one, this is also the range for the figure of merit.[5]

Experience with these metrics has shown that a good 'rule of thumb' is that about a third of any AC response matches about a third of any target by chance.

[5] The *figure of merit* was not used in the analysis of the two trials in this study, but it is included here for completeness.

So a 'chance' figure of merit is about 0.1. In the trials described in this paper, however, there was no a priori intent to design a statistically valid measure. Rather, accuracy, reliability and visual and conceptual correspondence with the targets were contributing factors to the design of later statistically-oriented experiments.

Accuracy and Reliability Computations

For this and the following trial, the elements in the USE were split into three categories according to whether they described target function, physical relationships among objects, or objects themselves. These categories were assigned weights of 1.0, 0.75, and 0.5, respectively; this indicates that functions were twice as interesting to the sponsor as were objects, and physical relationships were in between.

Three separate targets within this trial were identified depending upon where the beacon person was at the time of the session. The primary target system was the Advanced Technology Accelerator located approximately 15 km from Lawrence Livermore National Laboratory (LLNL) in California. A secondary target was the windmill farm at the Altamont Pass, and a tertiary target was the West Gate of LLNL. Since the sponsor was mostly interested in the accelerator, these targets were weighted 1.0, 0.50, and 0.25, respectively, to form weighted averages for accuracy and reliability for the trial.

Sixty-seven individual elements comprised the USE for the accelerator target, and Table 1 shows selected values of Ω, T, and R as illustrations. Ω represent the relative weights within a category (i.e. 1.0, 0.75, or 0.5) so that the w_k in the expressions for the accuracy and reliability are given by the product of the target weight and Ω. For example, w_k for "Tunnel" under Objects for the secondary target is ($\Omega = 0.5$) × (target weight = 0.5) = 0.25. The weighting factors and the membership values were assigned, *post hoc*, by the sponsor and May, both of whom were blind to the response.

Table 1 shows selected elements from the USE, their weighting factors, and their fuzzy-set membership values for the accelerator target. Similarly, Tables 2 and 3 show the same data for the windmill farm and West Gate of LLNL, respectively. For illustrative purpose, Tables 1–3 display only a small portion of the fuzzy sets for the targets and their associated responses.

Feedback

The participant was given verbal feedback immediately after the trial and was presented with photographic material of the accelerator, the windmill farm and the West Gate approximately six months later.

Results

Table 4 shows the accuracy and reliability derived from all 67 elements in the USE. The calculations are shown for the separate element categories for the accelerator target and summary data for the other targets.

Overall, 78% of what the participant contributed in his response was target-relevant, and 72% of the sponsor-defined target and weighted elements was described correctly. Qualitatively, this is more than twice what is expected by chance using the rule of thumb discussed above.

Table 1

Selected USE Elements, Weights, and Membership Values for the Accelerator Target

Elements (1.0)*	Ω	Target	Response
Functions (1.0)			
Directed energy	5	1	0.9
Electron acceleration	3	1	1
Beam ionizes air	1	1	0.6
Testing new form of laser	1	0	1
Relationships (0.75)			
Power source above beam line	1	1	0
Linear array of buildings	1	1	0.1
E&M radiation less than 10 angstroms	1	0.1	1
Pipes into and out of sphere	1	0	1
Objects (0.5)			
External electron beam	5	1	0
Tunnel	2	1	1
Loud noise	1	0.3	1
Hollow, polished (internal) sphere	1	1	1

*Category weights are shown in brackets

Table 2

Selected USE Elements, Weights, and Membership Values for the Windmills Target

Elements (1.0)*	Ω	Target	Response
Functions (1.0)			
Wind-powered electricity generator	2	1	0.9
Relationships (0.75)			
Poles scattered in hills	1	1	1
Poles connected in a grid	1	1	1
Objects (0.5)			
Foothills	1	1	1
Electric grid	1	1	1
Rotating blades	1	1	0.8
Multiple wind generators	1	1	1

*Category weights are shown in brackets

Table 3

Selected USE Elements, Weights, and Membership Values for the West Gate Target

Elements (1.0)*	Ω	Target	Response
Functions (1.0)			
Multipurpose laboratory complex	5	1	0.8
Six-story administration building	4	1	1
Relationships (0.75)			
T-shaped, six-story building	3	1	1
Swimming pool north-east of tall building	1	0	1
Large parking lot just west of tall building	1	1	1
Segmented 1-story buildings north of tall building	1	1	0.2
Objects (0.5)			
Tall building	2	1	1
Parking lot	1	1	1
Building with cylindrical shaped roof	1	1	0.4
Large mountains	1	0	1

*Category weights are shown in brackets

Table 4

Accuracy and Reliability Results for the Three Targets in this Trial

Target Type		Accuracy	Reliability
Accelerator (1.0)*	Functions	0.93	0.70
	Relationships	0.36	0.31
	Objects	0.73	0.88
	Weighted Totals	0.67	0.63
Windmills (0.5)	Weighted Totals	0.95	1.00
West Gate (0.25)	Weighted Totals	0.85	0.95
Combined Weighted Total		0.72	0.78

*Target weights are shown in brackets

Since the element weights, w_k, include the category weighting factors, the totals for each target type are linear averages; however, the combined total is a weighted average across target types with the weighting factors shown.[6]

[6] The complete fuzzy-set response is too long to include in this paper; however, it will be made available to interested researchers. Please contact Edwin May at may@lfr.org.

Samples of Visual Correspondence

Figures 1–3 (a & b) are representative samples to illustrate the qualitative correspondence for the accelerator, windmill farm and West Gate targets. The accelerator is shown as a partial drawing, but the remaining responses are the complete drawings for the targets.

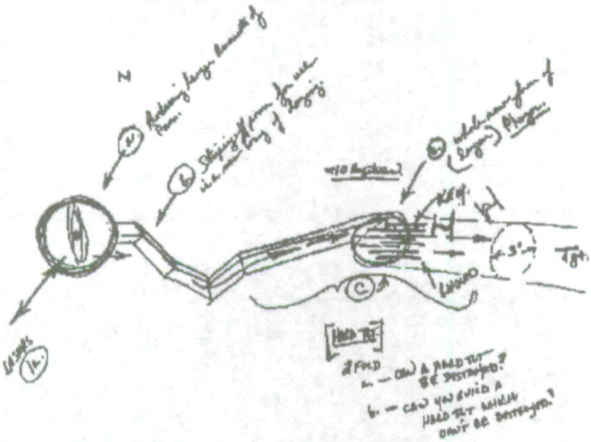

Figure 1a. Partial response to the primary accelerator target.

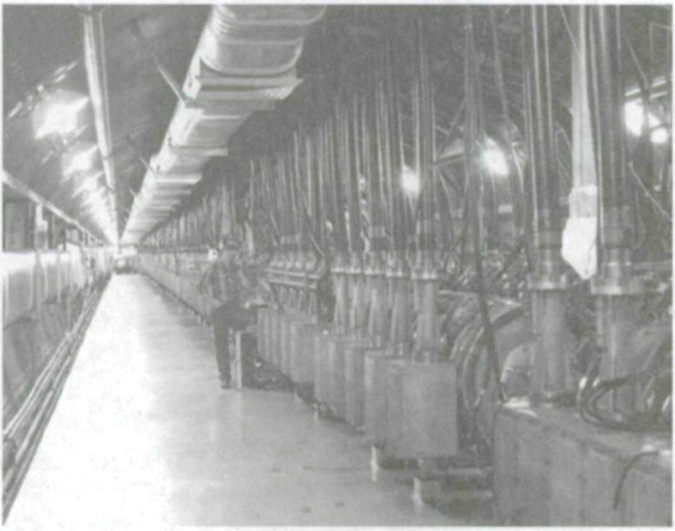

Figure 1b. Primary electron accelerator target.

The partial response shown in Figure 1a shows a beam being labelled as three feet in diameter whereas the actual electron beam is about 0.3 mm. But for the participant to even recognize there is a beam involved is not only a testimony for this participant's skill but for AC functioning in general.

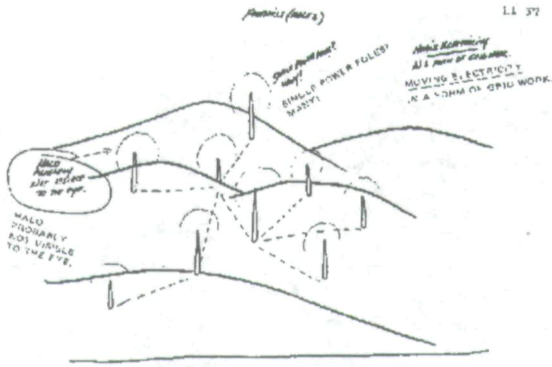

Figure 2a. Complete response to the secondary windmills target.

Figure 2b. Secondary windmills target.

As the accuracy and reliability shown in Table 4 indicate, this a near-perfect example of anomalous cognition.

The response in Figure 3a is so accurate that when we show it to people who are familiar with the nuclear laboratory, they easily identify the administration building (labelled 'A' in the response) and the layout as the West Gate of the lab. The general shape of that building was drawn correctly, including the correct number of floors.

Discussion

We see from Table 4 that everything that the participant said about the windmill farm was correct (i.e. gave a reliability of 1.00) and almost all of the sponsor-designated target elements were perceived correctly (i.e. accuracy of 0.95). Relatively speaking, however, the participant's response to the accelerator, itself, contained many elements that matched (at one time in the response he said "electrons coming down this, this tube'), but this correct information was embedded in a substantial amount of incorrect material. Perhaps one interesting point is that all the responses to the technical targets were technical and the response to the architectural target (i.e. LLNL West Gate) was architectural.

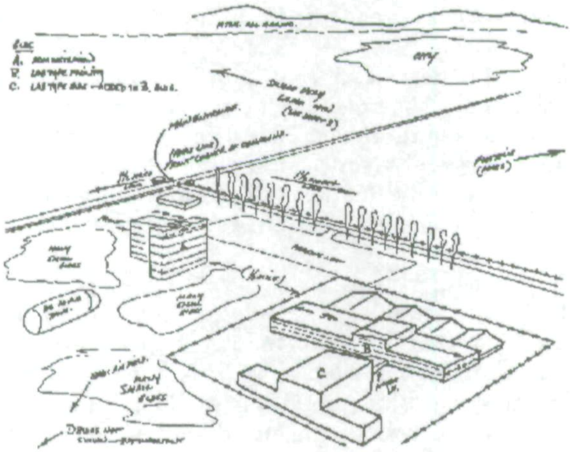

Figure 3a. Response to the West Gate, LLNL.

Figure 3b. Lawrence Livermore National Laboratory—West Gate.

One very important concept with regard to anomalous cognition, in general, appears quantitatively in this trial. Namely, using AC to determine physical relationships among various elements of a target is problematic. Here it is demonstrated in the accuracy and reliability for the relationships category for the accelerator of 0.36 and 0.31, respectively—a chance result that held for the other two targets in this trial.

There is surprisingly high accuracy for functions and high reliability for objects in the accelerator response, but the weighted averages of accuracy of 0.67 and reliability of 0.63 better reflect the qualitative correspondence with

the drawings. The values for the windmill and West Gate targets speak for themselves.

We will see in the next trial that how to combine or ignore various 'interesting' targets near the intended target is problematical. Although we down-weighted the lesser targets in this trial, their high-quality responses inflated the combined averages for accuracy and reliability beyond what might be expected on the basis of the qualitative correspondence alone for the primary accelerator target. In the next example the reverse was true.

Second Trial, August 1988

In this trial, the SRI team was completely blind to all details, with the exception that we knew that an event was to take place within the continental USA on 24–25 August 1988. As before, we were provided with the name and Social Security number of an individual who would be on-site during the event. The protocol was nearly identical to the one described above with the exception that no SRI International personnel would be present at the site and all were blind as to the target material and its location. It was known by all, however, that it would be in the continental USA.

Accuracy and Reliability Calculations

For this trial there was only a single target — a high-power microwave generator that was enclosed in a truck trailer in the New Mexico desert. Table 5 shows selected weighting factors and target and response elements from the USE, which contained 72 elements. These were determined *post hoc* by the sponsor and May.

Table 5

Selected Elements from the USE for the Microwave Generator Target

Category	Element	Ω	Target	Response
Function (1.0)*	High-power microwave production	5	1	0.8
	Destructive testing of electronics	2	1	1
	Ground focal area	1	0	1
	Testing a concept—debugging	1	0.3	1
Relationships (0.75)	Source enclosed in a trailer	5	1	0.7
	Energy exit enclosure	3	1	1
	Large semicircular shape with block	1	0	1
	Horn shape at end of 4 × 6 cm pipe	1	1	0.8
Objects (0.5)	Microwave generator	5	1	0.7
	Incoherent wave front	3	0.1	1
	Buried sensors	1	0	1
	Flat desert	1	1	1

*Category weights are shown in brackets.

Results

Table 6 shows the accuracy and reliability computed from all 72 elements in the USE. The calculations are shown for the element grouping for the microwave generator target.

Table 6

Accuracy and Reliability for the Microwave Target

Category	Accuracy	Reliability
Functions	0.88	0.80
Relationships	0.69	0.64
Objects	0.82	0.63
Weighted Totals	0.80	0.69

Feedback

One month after the trial, the participant was taken to New Mexico and allowed to view the device.

Samples of Visual Correspondence

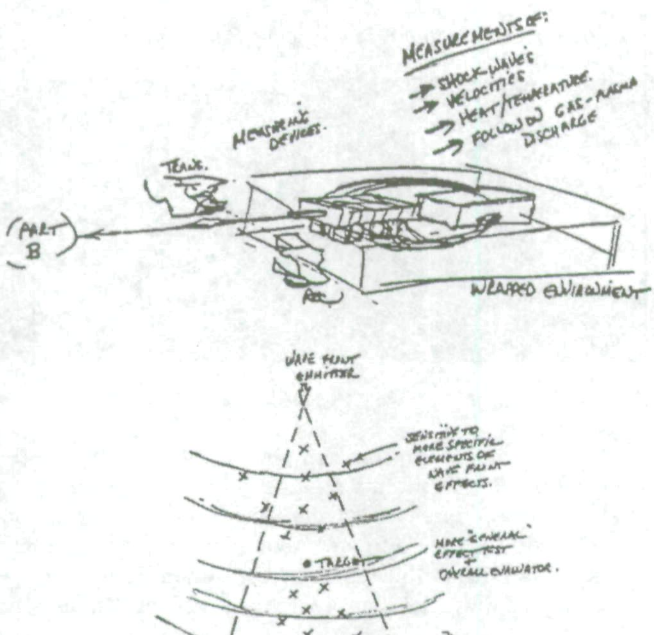

Figure 4a. Partial response to microwave target—I.

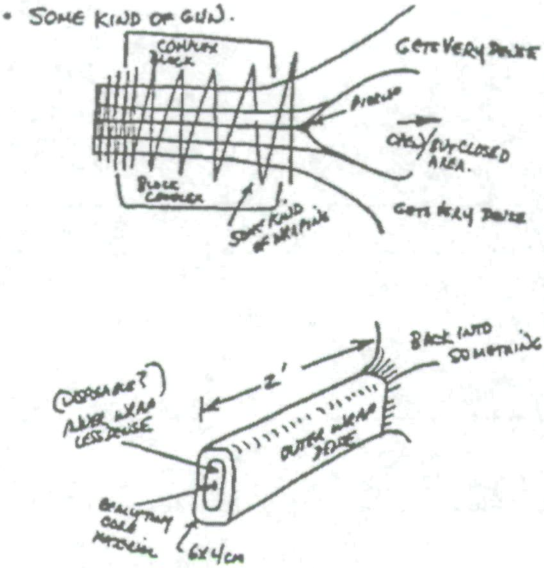

Figure 4b. Partial response to microwave target—II.

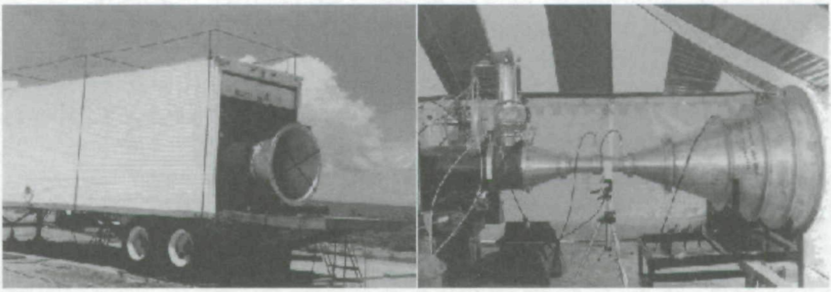

Figure 4c. Microwave target.

Figures 4a–4c show representative samples of the response to illustrate the qualitative correspondence to the microwave generator and its details. In this case the participant correctly assessed the function of the target and correctly identified the beam divergence angle of about 30 degrees. A reliability of 0.8 for functions also means that the response contained 20% incorrect material. Part of the correct response included a "wave guide" and microwave antenna horn drawing.

While some specific elements are incorrect, this response, alone, could have guided a skilled analyst to the correct conclusion that the target was a microwave generator device instead of a host of other high-technology possibilities.

Discussion

The accuracy and reliability for functions and objects are reasonably consistent with those shown for the accelerator target. However the increase in these values for the physical relationships is inconsistent with the earlier trial and with our overall observation that physical relationships among target elements are not well sensed by AC. At this time we cannot account for this increase.

General Discussions and Conclusions

One main property that distinguishes these two targets is that they both represent large changes of energy in a very short period of time. Concomitantly, they represent large changes of thermodynamic entropy as well. These are not two isolated cases. In our database dating from 1972, we have 12–15 similar examples. While some are better than others, we have no cases of a complete miss on such targets. This laboratory anecdote coupled with the quantitative, albeit *post hoc*, analyses of these trials from a single client were major contributing factors to the inspiration for our Shannon entropy experiments (Lantz, Luke & May, 1994; May et al., 1994; May et al., 2000) that were designed specifically to test the degree to which AC quality is enhanced with large entropy changes in the target.

It may be a significant leap of faith to imply that changes in thermodynamic entropy are in some way equivalent to changes in Shannon entropy; however, such a relationship has been shown to exist in the foundations of entropy theory (Leff & Rex, 1990).[7]

The two trials in this paper were actually accompanied by a third in 1990. The target was an underground explosion; however, our contract ended before we were able to conduct a fuzzy-set analysis. We were told by the sponsors that they felt that the qualitative correspondence was as good as the first two trials described in this paper.

When we were providing experiential feedback for the participant in the microwave trial, we drove past a solar collection power research facility. It was operating and presented a spectacular display of sparks and bright flashes of light. The solar collector is characterized by a large array of mirrors that focus the sun's energy on the top of a tower. As it so happened, this facility was approximately three kilometres from the microwave device testing area. We mention this feedback experience because the participant's first impression in the microwave trial was "ground focal area specifically laid out for 'catching' something evenly". Figure 5a shows his sketches and Figure 5b shows a photograph of the facility. Some of his response elements throughout the second trial were overlaid with mirrors and collection devices. What was particularly interesting, however, was the double lines in Figure 5a and the accompanying words from the transcription, "getting an impression of a, like a semi-circle that's open over here and there's some kind of a square block or something

[7] Although this reference demonstrates that the formalism for informational entropy is equivalent to thermodynamic entropy, it remains controversial whether the two types of entropy are functionally equivalent. However, the results from these influential examples of thermodynamic entropic changes have translated into the laboratory with informational entropic changes.

standing over here. This is really large. I feel like it's kind of laid out on the ground in some way". The participant recognized later in the session that there was a problem with his first large-football-size impression. He remarked in the transcript: "Actually this is totally separate. I'll draw a line between the two".

The intended target for this trial was the microwave generator, which was located in the desert near Albuquerque, New Mexico. But the participant may have been impacted by the substantial change of entropy of this active solar collector. Regardless, the solar collecting device and its response elements were included only in the response data to lower the reliability shown in Table 6 from what it might have been without the solar farm. As pointed out above, this is the opposite to what happened in the accelerator trial. This makes the combined accuracy and reliability in this trial that much more impressive.

In summary, these examples, which demonstrate apparent high-quality anomalous cognition, serve as some of the basis for the later development of a formal testable hypothesis: changes of target entropy correlate positively with the quality of anomalous cognition.

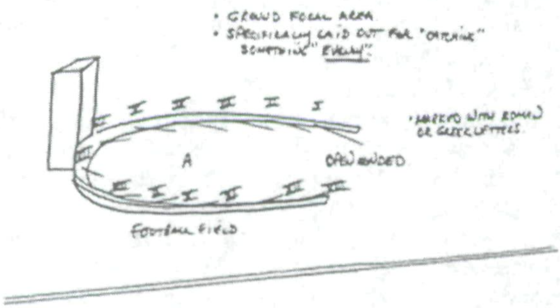

Figure 5a. Response to the nearby solar collector.

Figure 5b. Nearby solar collector farm.

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We would like to acknowledge Joseph W. McMoneagle as the participant in these trials. We all have worked together, now, for over 30 years. Joe has long ago quit being just another participant; rather, we all consider him as another member of the research team who is dedicated to understanding the mechanisms and nature of anomalous cognition. Thanks, Joe.

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REFERENCES

Honorton, C. (1975a) Error some place. *Journal of Communication 25 (1),* 103–116.

Honorton, C. (1975b) Objective determination of information rate in psi tasks with pictorial stimuli. *JASPR 69,* 353–359.

Jahn, R. G. (1982) The persistent paradox of psychic phenomena: an engineering perspective. *Proceedings of the IEEE 70 (2),* 35.

Jahn, R. G., Dunne, B. and Jahn, E. G. (1980) Analytical judging procedure for remote perception experiments. *JP 44,* 207–231.

Lantz, N. D., Luke, W. L. W. and May, E. C. (1994) Target and sender dependencies in anomalous cognition experiments. *JP 58,* 285–302.

Leff, H. S. and Rex, A. F. (eds.) (1990) *Maxwell's Demon: Entropy, Information, Computing.* Princeton, NJ: Princeton University Press.

May, E. C., Spottiswoode, S. J. P. and Faith, L. V. (2000) Correlation of the gradient of Shanon entropy and anomalous cognition: toward an AC sensory system. *Journal of Scientific Exploration 14 (1),* 53–72.

May, E. C., Spottiswoode, S. J. P. and James, C. L. (1994) Shannon entropy: a possible intrinsic target property. *JP 58,* 384–401.

May, E. C., Utts, J. M., Humphrey, B. S., Luke, W. L. W., Frivold, T. J. and Trask, V. V. (1990) Advances in remote-viewing analysis. *JP 54,* 193–228.

Puthoff, H. E. and Targ, R. (1976) A perceptual channel for information transfer over kilometer distances: historical perspective and recent research. *Proceedings of the IEEE 64 (3),* 329–354.

Schwartz, S. A. (2007) *Opening to the Infinite: The Art and Science of Nonlocal Awareness. Buda, TX: Nemoseen Media.*

Targ, E. and Targ, R. (1986) A study of the accuracy of paranormal perception as a function of target probability. *JP 50 (1),* 1–26.

Targ, R. (1975) Information transfer under conditions of sensory shielding. *Nature 251,* 602–607.

Targ, R. (1994a) Remote viewing replication: evaluated with concept analysis. *JP 58 (3),* 271–284.

Targ, R. (1994b) What I see when I close my eyes. *Journal of Scientific Exploration 8,* 111–118.

Targ, R. (1996) Remote viewing at Stanford Research Institute in the 1970s. *Journal of Scientific Exploration 10,* 77–88.

Targ, R., Katra, J., Brown, D. and Weigand, W. (1995) Viewing the future: a pilot study with an error-detecting protocol. *Journal of Scientific Exploration 9 (1),* 67–80.

Targ, R., Targ, E. and Harary, K. (1984) Moscow–San Francisco remote viewing experiment. *Psi Research 3 (3/4),* 74–82.

Zadeh, L.A. (1965) Fuzzy sets. *Information and Control 8 (3),* 338–353.